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IMPLEMENTATION OF SINGLE PHASE ELECTRONIC TRANSFORMER (SPET) USING SINGLE-PHASE MATRIX CONVERTER (SPMC) TOPOLOGY

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AUTHOR'S DECLARATION

I declare that this work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. The topic has not been submitted to any other academic institution or non institution for any other degree or qualification.

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ABSTRACT

This work is concerned on the investigation of electronic transformer (ET) using single phase matrix converter (SPMC) topology. The ET implement SPMC as a two stage converter, one that performs high frequency conversion to provide a high input frequency supply to the transformer and another that reduces the output frequency of the transformer as an interface to the load connected. Successful operation could lead to high frequency operation of the transformer, leading to smaller transformer design for the same power handling requirements. The SPMC is proposed to ensure limited reactive device use but in the presence of transformers and reactive devices; damaging high voltage and high current spikes arises and need to be mitigated using new safe-commutation technique. The output of ET is controlled using PWM technique implemented using XILINX FPGA digital control as the control electronics implementation. Simulation is carried out using MATLAB/Simulink (MLS) and Pspice to investigate the behaviour and basic operation of the ET before practical laboratory implementations. It is presented that the SPMC is capable of being operated as primary and secondary converter in ET to realize high frequency operation on the transformer. An experimental laboratory work was then constructed to verify results obtained from both simulations. It is presented that the proposed ET using SPMC as a two stage converter had been successfully developed and realized complete with a new-implemented safe-commutation strategy to mitigate the high voltage and high current spikes as the effect of transformer and reactive device being used.

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